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The Canadian-American Committee

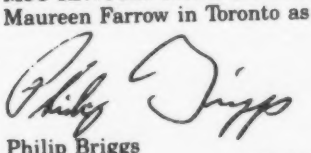
The Canadian-American Committee was established in 1957 to study and discuss the broad range of economic factors affecting the relationship between Canada and the United States. Its members are business, labor, agricultural, and professional leaders from the private sector who have direct involvement and experience in relations between the two countries. There is approximately equal membership from both nations, with the objective of obtaining representative views from the major geographic regions and industrial sectors in each. The Committee is sponsored by two nonprofit research organizations—the National Planning Association in the United States and the C.D. Howe Institute in Canada, described at the end of the volume.

The Committee believes that the maintenance of a cooperative relationship between the two countries is in the best interests of both. At the same time, the Committee recognizes that the evolution of the bilateral relationship will produce occasional strains and conflicts. Accordingly, it seeks to encourage greater public understanding of the nature of issues of bilateral importance and attempts to develop and disseminate ideas for constructive policy responses that are consistent with the national goals of the two countries.

To encourage greater public understanding, the Committee sponsors objective research studies on various aspects of Canadian-American relations. These studies are prepared by experts in both countries and, with the Committee's approval, are published. On the basis of these factual studies and of discussions at its meetings, the Committee also issues policy statements signed by its members. A partial listing of Committee publications is given on the inside back cover.

The Canadian-American Committee is a unique organization in terms of both its broadly diversified membership from the private sector and its sponsorship of a coordinated publication program combining factual studies and policy-oriented statements on Canadian-American relations. It meets twice a year, once in each country; these meetings provide an opportunity for members to discuss a wide range of topics with senior government officials, scholars and other people with a specialized knowledge of the relationship. The work of the Committee is financed by funds contributed from private sources in the two countries. Foundation grants made it possible to initiate the Committee and are an additional source of financing for specific research studies undertaken by it.

Offices on behalf of the Committee are maintained at 1616 P Street, N.W., Suite 400, Washington, D.C. 20036, and at 125 Adelaide Street East, Toronto, Ontario M5C 1L7. Peter Morici serves in Washington as the U.S. Research Director and Maureen Farrow in Toronto as the Canadian Research Director.



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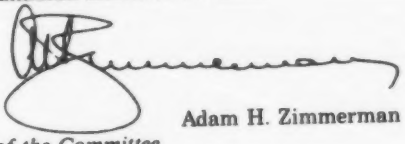

Adam H. Zimmerman

Cochairmen of the Committee

Meeting the Competitive Challenge: Canada and the United States in the Global Economy

Peter Morici

Canadian-American Committee

Sponsored by
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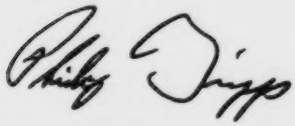
Foreword

Since its establishment in 1957, a major objective of the Canadian-American Committee has been to provide a better factual basis for public discussion and resolution of bilateral issues. Through the early 1980s the Committee's attention and publications were typically focused on developments of mutual interest to Canadians and Americans occurring anywhere between the Rio Grande and the Arctic Circle. More recently we have observed that an increasing number of issues in Canadian-U.S. relations arise from unilateral policy responses taken by one country or the other to cope with global economic pressures. For example, in the early 1980s Canadian reactions to the energy crisis increased bilateral tensions as, more recently, did the U.S. responses to its trade deficit in industries such as steel.

The Committee has responded by publishing several studies illuminating global economic pressures and their consequences for Canadian-U.S. relations. In June 1987 we published *Global Imbalances and U.S. Policy Responses: A Canadian Perspective* by Richard G. Lipsey and Murray G. Smith, which examined the U.S. budget and trade deficits and how alternative approaches to addressing them would affect bilateral relations. In July 1987 we published *U.S. and Canadian Auto Policies in a Changing World Environment* by Paul Wonnacott, which examined the stresses on the North American auto industry and in the Canadian-U.S. Automotive Agreement engendered by the globalization of production.

Meeting the Competitive Challenge: Canada and the United States in the Global Economy, by Peter Morici, provides an American perspective on the longer-term structural challenges confronting the two economies across a broad range of industries. It examines longer-term competitive issues relating to productivity, wages, exchange rates, and the creation and diffusion of new technology that our two countries will be addressing even after federal budget deficits have been brought down and the new bilateral trade agreement has been implemented.

Publication by the Committee does not imply that all of the members endorse the author's specific points or conclusions. The Committee believes, however, that his analysis of the issues deserves wider consideration.



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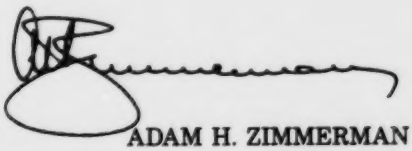

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John Mutti provided revised and updated manufacturing output data for the six advanced industrialized countries discussed in this study.

Denise Gamba and Carlton Strong deserve special thanks for preparing much of the statistics and for background research.

Introduction

Over the past two decades, policymakers in government and the private sector have been confronted by a series of major challenges—forecasts of global food shortages, the energy crisis and the great inflation. Now the competitiveness challenge has emerged, by most accounts, as the policy problem of the late 1980s. Each of the previous challenges, although seemingly intractable, was eventually addressed. However, how effectively and wisely we cope will importantly affect the real incomes and quality of life of our citizens.

The purpose of this study is to examine the key sources of the competitiveness challenge confronting the United States and Canada. This challenge did not emerge overnight; rather, it is the result of fundamental structural trends in the international economy and in the domestic economic performance of both countries that date back several decades. It is important to recognize that the current situation is the product of the interaction of private decisions and public policies over the past 20 or more years. It also should be noted that differences in population, resources and culture have created different views in each country of how governments should assist in the process of industrial development. Chapter 1 examines this historical perspective.

In assessing the debates, actions and performances, it is important to recognize that the competitiveness challenge is frequently discussed at two levels: the macro or national level—e.g., trade balances, aggregate productivity growth, wage rates, living standards, exchange rates, international capital flows, domestic savings and investment, and government budget deficits; and at the micro or industry level—e.g., the net import and export positions and market shares of individual sectors of the two economies. While macro and micro issues are clearly connected, it is useful to discuss competitiveness at these two levels separately. Chapter 2 examines national competitiveness. Chapter 3 discusses industry issues—what economists call comparative advantages.

Arguments for policies that focus on one or a few factors can have great appeal. However, complex problems require concerted action on several fronts—the competitiveness challenge is no different. Chapter 4 concludes with a discussion of the range of policies that public and private sector leaders should address to improve North American industrial performance.

1

Historical Background

The United States and Canada emerged from World War II in artificially strong competitive positions. Spared wartime destruction, North American mines and factories were needed to rebuild Europe and Japan. The Marshall Plan and aid to Japan provided the financing until their economies could get off the ground, and U.S. and Canadian private sectors provided the goods and services.

The United States

The U.S. position was unique in at least two ways. First, by today's standards it was not dependent on foreign trade—in 1950 exports plus imports were only 8 percent of U.S. GNP, compared with 47 percent for Canada, and 45 and 30 percent for Great Britain and France, respectively. Second, as a legacy of the war, the United States appeared to have a competitive edge in virtually all industrial activities. Under the Bretton Woods system, the United States ran persistent trade surpluses and undertook foreign investments exceeding those surpluses, creating a supply of dollars abroad that provided the liquidity for expanding world trade.

By the 1960s the European economies had recovered from the devastation of the war. Coupled with the economic efficiencies provided by the formation of the European Community, the recovery gave rise to spirited, though not truly threatening, competition for U.S. industries. During this decade other profound changes began to emerge in the competitive conditions facing the advanced industrialized countries (AICs) of North America and Europe. The rise of Japan as a major exporter and the rapid economic growth of the newly industrializing countries (NICs) created substantial adjustment problems in a succession of labor-intensive mobile manufacturing industries with standardized production technologies, such as textiles, apparel, furniture, and footwear. Subsequently, the challenge spread to capital-intensive heavy industries producing standardized products on long production runs, such as steel, nonferrous metals and automotive products.

As U.S. consumption of imported manufactures grew, U.S. payments for foreign oil also increased, and U.S. reliance on exports to pay for those imports expanded. From 1950 to 1969 U.S. exports rose from 5.0 percent of GNP to only 6.1 percent. However, by 1979 this figure had jumped to 11.6 percent—the U.S. economy had been internationalized. American

consumers had acquired a taste for imported products; U.S. success in foreign markets would be necessary to pay for them.

Economists and policymakers anticipated that the United States could pay for these increased imports by emphasizing comparative advantages in agriculture, services and high technology. This strategy did not prove easy because of other structural developments (discussed in Chapter 3) that have fundamentally altered the international market conditions confronting American industry. During the 1980s attention has been distracted from these important structural problems by large federal budget deficits and the exchange rate movements and balance-of-trade deficits they helped precipitate.

Canada

During World War II Canada's role as one of the "arsenals of democracy" substantially increased its manufacturing capabilities in industries such as aluminum, rubber, aircraft, uranium, shipbuilding, and steel. This progress in manufacturing continued into the early postwar years.

In the 1950s Canada enjoyed a sustained period of economic expansion and emerged as a staunch supporter of trade liberalization and the General Agreement on Tariffs and Trade (GATT). With the United States, it sought a positive, constructive role in shaping open and integrated markets for goods and capital; it welcomed foreign investment; and it had a minimum of government institutions for industrial policymaking and intervention in market processes. Then as now, Canadian industrial progress was closely linked to U.S. economic performance and policies. From 1951 to 1972 the U.S. share of Canadian exports grew from 59 to 69 percent. In 1970 foreign ownership of Canadian mining and manufacturing was 59 and 53 percent, respectively, with Americans holding more than four-fifths of those investments.

Starting in the late 1950s and early 1960s, several internal and external trends precipitated a reevaluation of Canada's basic approaches to trade and industrial policy and, in particular, of its relationship with the United States.

First, the economic reconstruction of Japan and Europe and the emergence of the European Community (EC) and the European Free-Trade Association left Canada as one of the few modern industrialized economies without tariff-free access to a market of 100 million people.[1] It became apparent that Canadian industry would benefit from the ra-

1. Australia and New Zealand are in similar situations and, like Canada, have been highly dependent on natural resources and agricultural exports.

tionalization and economies of scale that assured free access to a broader market could provide. In this context, Canada's trading relationship with the United States attracted attention, as evidenced by the publication of several important studies (for example, Wonnacott, 1967; Lea, 1963; and the staff of the Canadian-American Committee, 1965).

Second, liberalization of trade and capital movements helped create a favorable environment for the global growth of large multinational corporations. MNCs became important vehicles for expanding trade and disseminating capital and technology. Some in Canada perceived MNCs as exerting considerable influence over the location and structure of production and employment opportunities, as well as the content of trade. Whether the high degree of foreign ownership and control best served Canada's national interest, including its industrial development goals, emerged as a critical public policy question.

Third, employment, income and educational issues became increasingly prominent. These included persistent disparities in incomes and employment opportunities among Canadian regions (e.g., lagging progress in Quebec and the Atlantic provinces), the challenge of absorbing the baby boom cohort into the labor market, and the adequacy of Canadian educational institutions and technical and vocational training.

Finally, concerns were growing that the U.S.-Canadian economic integration was fostering a cultural and social integration in which U.S. institutions would ultimately dominate. For example, in discussing expanding commercial ties, the 1970 Canadian White Paper on foreign policy stated: "While such developments should be beneficial for Canada's economic growth, the constant danger that sovereignty, independence and cultural identity may be impaired will require a conscious effort on Canada's part to keep the whole situation under control" (External Affairs, 1970).

Together these trends generated an enormous impetus for actions and institutional changes intended to foster industrial adjustments and to establish more proactive economic and cultural policies that would assert Canadian independence in a growing bilateral trade and investment climate. Although space and focus do not permit a full exposition here, it is reasonable to say that this explosion of initiatives culminated in the Trudeau years, when Canada may be characterized as having pursued a two-track approach to international trade and economic policy.

First, throughout the postwar era, Canada recognized the important benefits of market entry and the rules of access it received through participation in the GATT, and Canada continues to be one of the strongest advocates and defenders of the multilateral system. As a small country, Canada can ally itself with nations having common interests and thereby achieve more leverage than it might have in direct negotiations with larger trading partners. Also, as a small country, its concessions are less significant to the successful conclusion of multicountry agreements—

e.g., a package of multilateral tariff reductions in which the United States, Japan and the EC are the other principal players. Indeed, Canada did not view the across-the-board tariff reductions agreed to in the Kennedy Round as serving its interests and thus did not fully participate in the cuts. When these reductions were completed in 1972, Canada still had much higher average tariffs than the other AICs. Under Prime Minister Trudeau, though, Canada agreed to full participation in the Tokyo Round across-the-board tariff reductions. Having started from a higher base, however, Canada's tariffs generally remain above those of the other major AICs.

Second, Trudeau sought to lessen Canada's dependence on the United States, the so-called Third Option, and to influence patterns of economic development through the implementation of new foreign investment and economic development policies. The goals of this industrial policy included increased national benefits from the development of natural resources, rationalization of manufacturing to meet growing international competition, greater Canadian participation in high technology industries, and greater Canadian ownership and control over the means of production, especially in the resource sector. The tools included: extensive financial incentives to promote industrial adjustment and regional development, R&D and technology-intensive activities; stringent monitoring and screening of new foreign investment with the establishment of the Foreign Investment Review Agency; aggressive procurement and energy policies; and establishment of the quasi-public Canada Development Corporation (a holding company). During the 1970s Canadian optimism about these strategies was buoyed by strong markets for its energy and other resource-based exports. Indeed, the October 1980 federal budget introducing the National Energy Program and the November 1981 federal budget included plans to use the rents from high energy prices to provide increased industrial, regional and R&D incentives (Morici *et al.*, 1982).

Despite these efforts, Canada's economic future continues to be linked to American prosperity and policies. U.S. ownership of Canadian enterprises has declined but still remains high. U.S. share of Canadian trade has not decreased. Most important, the industrial policies failed to appreciably improve Canadian competitiveness. During the final Trudeau years, as the global economy became gripped in a major recession and the outlook for Canada's resource exports weakened, these policies were curtailed. Meanwhile, U.S. competitiveness problems gave impetus to protectionist sentiments in the United States, raising concerns in Canada about its continued access to the U.S. market. Canadians began to look for alternative approaches to economic policy and initiated two important investigations—the *Trade Policy Review* and the *Royal Commission on the Economic Union and Development Prospects for Canada* (the Macdonald Royal Commission). These reports approached the challenges to Canadian trade policy with

a clean sheet and centered a new agenda for the discussion of Canada's policy options around negotiating full and secure access to the U.S. market and closer cooperation with the United States.

Although Canadians remain concerned about the long-term consequences of their relationship with the United States, policies are now focused more on ensuring the competitive restructuring of Canadian industry for global markets than on limiting the intensity of bilateral ties to manage the downside risks associated with American influence.

Deficits and Exchange Rates

From 1981 to 1986 the U.S. budget deficit rose from $61 billion to $205 billion, exhausting available U.S. domestic savings and requiring large capital inflows to finance current consumption. From 1980 to September 1985 the real effective exchange rate for the U.S. dollar rose 45 percent;[2] the U.S. current account moved from a $7 billion surplus in 1981 to a $141 billion deficit in 1986, and the United States amassed the world's largest external debt. These deficits greatly increased unemployment and adjustment costs in mature industries already reeling from expanding international competition and caused many U.S. technology-intensive industries to lose customers and market shares abroad.

For Canada, linked so closely to U.S. fortunes, the consequences were equally significant. From 1981 to 1985 the Canadian dollar fell about 12 percent against the U.S. dollar but also followed the U.S. dollar up against European currencies and, initially, against the yen (see Table 1). As a consequence, while Canada's current account and merchandise trade balances improved vis-à-vis the United States, they deteriorated dramatically against other countries.

	Current Account		Merchandise Trade	
	U.S.	All Other	U.S.	All Other
		(Bill. Can. $)		
1981	−7.9	1.8	3.3	4.0
1982	−1.7	4.5	11.0	6.6
1983	2.6	0.5	13.7	3.8
1984	7.2	−3.8	19.1	1.2
1985	8.6	−9.8	20.5	−3.6

The improved Canadian competitiveness in the U.S. market, coupled with reduced competitiveness against other producers abroad, further

2. The Morgan Guaranty trade weighted index for the dollar against 18 industrial country and 22 developing country currencies adjusted for inflation.

TABLE 1

U.S. AND CANADIAN EXCHANGE RATES AND CURRENT AND MERCHANDISE BALANCES, 1979–86

	UNITED STATES			CANADA									
				Index of Can. $ Against									
	Fed., State & Local Balance	Cur. Acct. Balance	Real Effective Exch. Rate	U.S. $	Ger. DM	Yen	Cur. Acct. Balance w/... Total	U.S.	All Other	Merchandise Balance w/... Total	U.S.	All Other	U.S. Share of Can. Exports
	(Bill. U.S. $)		(1980–82 = 100)	(1981 = 100)			(Bill. Can. $)			(Bill. Can. $)			(%)
1979	11.5	– 1.0	91.4	1.02	0.83	1.01	–4.9	–7.6	2.7	4.4	0.6	3.8	69
1980	– 34.5	1.9	90.5	1.03	0.83	1.05	–1.1	–7.9	6.8	8.8	1.6	7.1	64
1981	– 29.7	6.9	99.8	1.00	1.00	1.00	–6.1	–7.9	1.8	7.3	3.3	4.0	66
1982	–110.8	– 8.7	109.7	0.97	1.05	1.10	2.8	–1.7	4.5	17.7	11.0	6.6	69
1983	–128.6	– 46.2	114.9	0.97	1.10	1.05	3.1	2.6	0.5	17.5	13.7	3.8	73
1984	–101.5	–107.0	120.8	0.93	1.17	1.00	3.4	7.2	– 3.8	20.2	19.1	1.2	76
1985	–136.3	–116.4	124.0	0.88	1.14	0.95	–1.2	8.6	– 9.8	16.9	20.5	–3.6	79
1986	–143.1	–141.4	107.3	0.86	0.83	0.66	–9.3	5.8	– 15.1	10.4	17.4	–7.0	78

Sources: *Bank of Canada Review* (September 1987); *Economic Report of the President, 1987; Survey of Current Business* (April 1987); Morgan Guaranty, *World Financial Markets*, various issues.

increased U.S. dominance of Canadian export trade. From 1981 to 1985 the U.S. share of Canadian exports rose from 66 to 79 percent. Also, while Canadian dependence on U.S. markets was growing, Canada's weaker dollar gave rise to concerns in Congress that Canada was enjoying an unfair advantage.

Since the Plaza Agreement in September 1985, the U.S. dollar has nearly fallen to its 1980 level.[3] Studies of the causes and effects of the dollar's rise and fall addressed important questions, including:

> Has the U.S. dollar fallen far enough to redress trade imbalances? If not, how much further will it have to fall? What other adjustments are required? Can substantial reductions be achieved in the U.S. current account deficit without further cuts in the federal budget deficit and improved savings performance?

These issues are complicated by the fact that while the U.S. dollar has fallen greatly against the mark and the yen, it has not moved nearly as much against many important East Asian and Latin American trading partners. This is especially significant because these countries accounted for over one-fourth of the U.S. trade deficit in 1986 and have continued the rapid expansion of their export capabilities in manufactures.

What can be said is that U.S. trade and current account deficits will not likely relent until the United States further reduces its budget deficits or falls into a deep recession. However, foreigners will not be willing to accumulate increasing amounts of U.S. dollar-denominated assets indefinitely. At some point the United States will be required to service the debt through means other than more capital inflows. Fewer imports, more exports and lower levels of consumption by Americans will likely be required in the 1990s to pay for the spending spree of the 1980s.[4] This will require stronger U.S. merchandise trade balances than in 1980–81 when the current account was last in equilibrium. Bergsten (1987) estimates an approximate $200 billion swing in the U.S. merchandise trade balance—mostly in manufactures and 4 to 5 percent of GNP—will be required. How the United States ultimately resolves these problems will have significant consequences for the structure of Canadian trade and prosperity.

---

3. The Morgan Guaranty real index against 40 other currencies rose from an average of 90.5 in 1980 to a peak of 131.5 in February 1985; in September 1985 it was 122.6, and in December 1987 it was 91.2.

4. Continued economic growth will permit more imports and higher consumption levels in the 1990s than in the 1980s but lower levels than would have been possible had the United States not borrowed abroad during the 1980s.

This line of discussion, while useful, can distract attention from the deepening structural problems that strongly affect what Canadians and Americans will produce, what they will export and what they will earn through the end of the century. At the macro level these problems include a continuation of disappointing U.S. and Canadian productivity growth; at the industry level they include shifts in competitive relationships among nations that were already taking place during the 1970s.

2

Long-Term Macroeconomic Problems

Defining National Competitiveness

The President's Commission on Industrial Competitiveness (1985) defined competitiveness as ". . . the degree to which a nation, under free and fair market conditions, produces goods and services that meet *the test of international markets* while simultaneously maintaining and expanding the *real incomes* of its citizens" (emphasis added). This definition is a useful point of departure if we keep in mind that competitiveness is a comparative concept; the test of international markets really boils down to how the price and quality of North American goods and services compare with those of other countries. Progress in real incomes is difficult to judge without comparisons with past rates of growth or progress in other countries. Further, for such comparisons to be valid measures, real incomes must be sustainable—raising living standards through foreign borrowing does not reflect improved competitiveness.

U.S. and Canadian productivity levels and productivity growth are the most reliable indicators of the U.S. and Canadian long-term ability to produce products that compare well in price and quality with those of other nations and to maintain and expand sustainable living standards.

The Productivity Problem and What It Portends

For more than two decades U.S. and Canadian productivity growth in all the major economic sectors—agriculture, manufacturing and services—has lagged behind their principal competitors.

Average Annual Productivity Growth, 1960–85
(Percent)

	Agriculture	Industry	Mfg.	Services	Total Economy
United States	3.4	1.7	2.8	0.9	1.3
Canada	3.5	2.3	2.6	1.4	1.9
Japan	4.9	6.4	7.7	4.1	5.6
Germany	5.3	3.5	3.7	2.3	3.2
EC	5.3	3.6	4.1	2.0	3.2

Source: OECD, *Historical Statistics 1960–85* (Paris, 1987).

TABLE 2

AVERAGE ANNUAL PRODUCTIVITY GROWTH BY SECTORS, 1960–73 AND 1973–85 (Percent)

	Agriculture		Industry		Manufacturing		Services	
	73/60	85/73	73/60	85/73	73/60	85/73	73/60	85/73
U.S.	4.1	2.7	2.2	1.1	3.4	2.2	1.5	0.3
Canada	6.2	0.7	3.8	0.8	4.1	1.2	1.2	1.6
Japan	7.7	2.0	8.8	4.0	9.5	5.7	6.3	1.8
Germany	6.3	4.2	4.4	2.5	4.6	2.8	3.0	1.7
France	6.2	4.9	5.5	3.1	6.4	3.3	3.3	1.1
U.K.	6.1	3.6	3.0	2.4	3.6	2.2	2.5	1.1
EC	6.1	4.6	4.6	2.6	5.3	2.8	3.0	1.0

Source: OECD, *Historical Statistics 1960–85* (Paris, 1987).

Since the early 1970s, productivity growth has slowed in all the major AICs (see Table 2). The problem has been most severe in North America. One important reason has been the large increase in the labor force. As a result of the baby boom and continued immigration, the United States and Canada have had the difficult task of absorbing more workers into the labor force than Europe and Japan (see Figure 1 and Table 3).[1]

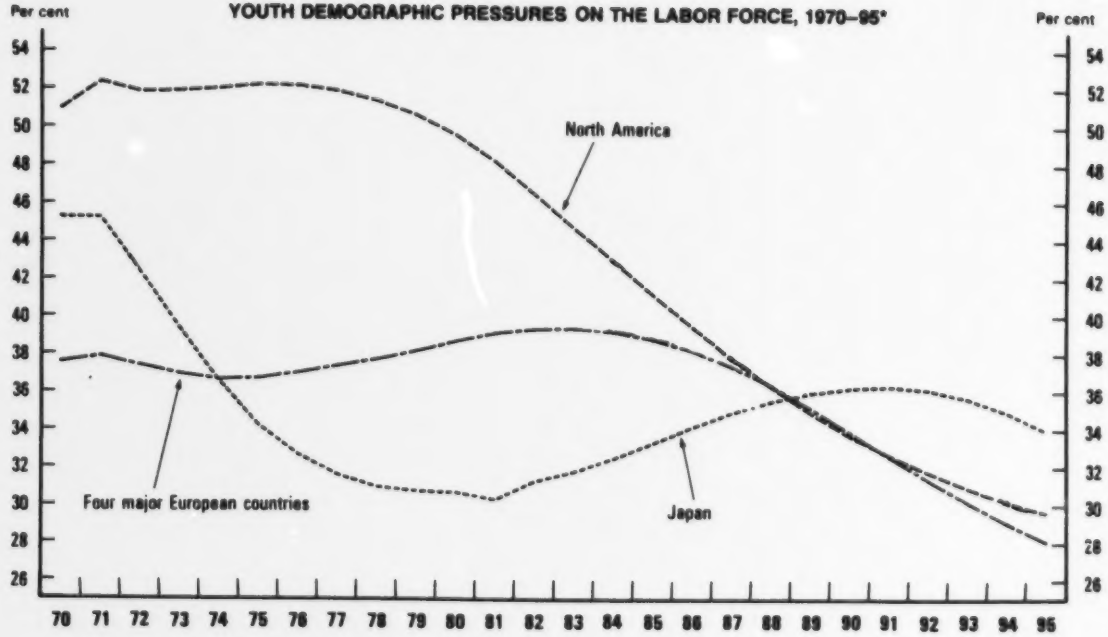
Another reason is that the U.S. share of GDP devoted to investment has lagged behind almost all of the U.S.'s principal competitors (see Table 3), causing the amount of capital available to workers to grow more slowly. Although Canadian investment performance has been more favorable, it has not been strong enough to maintain productivity growth given Canada's rapid labor force increase.

International comparisons of national levels of productivity are much more difficult to undertake than comparisons of growth rates. In the critical manufacturing sector, though, it is clear that the North American productivity advantage in manufacturing has been substantially reduced. According to Daly and MacCharles, overall manufacturing productivity in Japan and Germany are now close to U.S. levels, and Canada has been overtaken by these countries (see Table 4). According to Baumol and McLennan, overall Japanese manufacturing productivity may now equal or have surpassed U.S. levels (see Figure 2). It is thus apparent that, in at least some sectors, Japanese productivity exceeds U.S. levels.

1. This challenge was made larger by the increased participation of women in the labor market.

FIGURE 1

YOUTH DEMOGRAPHIC PRESSURES ON THE LABOR FORCE, 1970–95*



* The vertical axis shows the youth population aged between 15 and 24 years divided by the "prime-aged" population between 25 and 54 years.

Source: *OECD Outlook* (December 1986), p. 29, reprinted by permission.

TABLE 3

INTERNATIONAL COMPARISONS OF SAVINGS, INVESTMENT, EMPLOYMENT, GDP, AND PRODUCTIVITY, 1960–73 AND 1973–85
(Percent)

	SAVINGS (Shares of GDP)		INVESTMENT (Shares of GDP)		EMPLOYMENT (Average Annual Rates of Growth)		REAL GDP (Average Annual Rates of Growth)		PRODUCTIVITY (Average Annual Rates of Growth)	
	73/60	85/73	73/60	85/73	73/60	85/73	73/60	85/73	73/60	85/73
U.S.	19.8	18.7	18.2	18.4	1.9	2.0	3.9	2.5	2.0	0.6
Canada	21.8	21.5	22.4	22.5	2.8	2.2	5.4	3.3	2.6	1.2
Japan	35.3	31.8	32.8	30.1	1.3	0.9	9.6	3.8	8.2	3.0
Germany	27.2	21.9	24.8	20.9	0.2	−0.4	4.4	1.8	4.2	2.1
France	25.2	21.2	22.8	21.5	0.7	0.0	5.6	2.1	4.8	2.1
U.K.	19.4	18.0	18.4	18.1	0.3	−0.3	3.1	1.4	2.8	1.6
EC	24.2	20.7	22.2	20.4	0.3	−0.1	4.7	1.8	4.5	1.9

Source: OECD, *Historical Statistics 1960–85* (Paris, 1987).

TABLE 4

COMPARATIVE LEVELS OF OUTPUT PER HOUR, MANUFACTURING SECTOR, SELECTED COUNTRIES AND WAGES
(United States = 100)

A. OUTPUT PER HOUR

	1950	1960	1970	1980	1985	1986
U.S.	100	100	100	100	100	100
Canada	52	63	72	75	72	69
Japan	11	22	47	76	85	84
Germany	34	58	78	93	92	91
France	29	39	56	71	73	72
U.K.	33	34	37	37	40	40

B. WAGES

	1950	1960	1970	1980	1985	1986	1987 (est.)
U.S.	100	100	100	100	100	100	100
Canada	63	77	79	85	86	84	88
Germany	21	30	55	125	74	101	122
Japan	7	10	23	57	50	72	84
France	26	29	39	91	58	78	90
U.K.	26	29	32	76	48	57	64

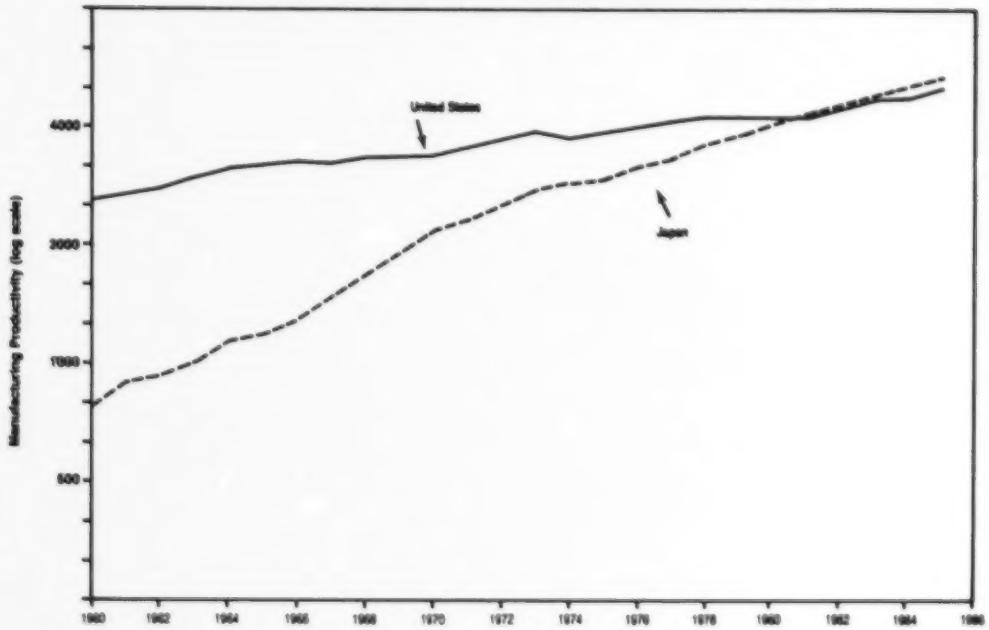
Addenda:

	1975	1980	1985	1986	1987 (est.)
Taiwan	6	10	11	13	16
Korea	6	10	10	11	12
Singapore	13	15	19	17	18
Hong Kong	13	15	14	14	15

Sources: D.J. Daly and D.C. MacCharles, *Focus on Real Wage Unemployment* (Vancouver: The Fraser Institute, 1986); Bureau of Labor Statistics; author's estimates.

FIGURE 2

U.S. AND JAPANESE MANUFACTURING PRODUCTIVITY, 1960–85



Source: Adapted from William J. Baumol and Kenneth McLennan, *Productivity Growth and U.S. Competitiveness* (New York: Oxford University Press, 1985), p. 15; updated data provided by Kenneth McLennan.

In addition to the age composition and quality of the labor force and the availability of new capital, productivity is critically affected by how effectively labor, capital and other resources are organized and managed, the climate for labor-management cooperation, and the attention and priority attached to quality and to consumer acceptance. This nexus of factors is often referred to as the "soft" side of the productivity equation. Excellence in these areas is dependent on the efficient application of modern, scientific management practices (discussed immediately below), as well as the attention given to the changes in corporate structures and the human resource management necessary to implement new technologies effectively (discussed in Chapter 3).

During the early 1980s many observers, including this author, attributed significant importance to Japanese management practices in explaining the Japanese ability to produce comparable if not better goods with fewer workers and less fixed capital and inventory and to implement quality improvement and cost-cutting measures quickly. A frequently cited example was the $2,000 Japanese cost advantage in subcompact automobiles estimated for the 1983 model year. While the size of such estimates is significantly affected by exchange rates, the breakdown of this cost advantage was revealing, as it was not generally influenced by currency values. Only 28 percent was attributed to lower wages or superior technology, while 63 percent was estimated to result from better management techniques (e.g., just-in-time inventory), and 8 percent from better labor-management relations (Morici, 1984).[2]

In the past several years, American manufacturing firms have increasingly turned to nonhardware productivity improvements, adopting Japanese management practices and reducing overhead by trimming central management and staff. This strategy reflected U.S. firms' growing awareness of the potential for soft productivity gains and the competitive pressures imposed by a strong dollar.

During the recent recovery, a jump in U.S., but not Canadian, productivity performance has resulted, without a substantial increase in U.S. manufacturing investment (see Table 5). Since 1979, U.S. manufacturing

2. In another example, Magaziner and Reich (1983) analyzed the 1979 cost differential for 19-inch color televisions between one of the then four remaining U.S. producers, a low and a high cost Japanese producer operating in Japan, and a low and a high cost Japanese producer in the United States. They concluded that the Japanese cost advantage resulted from the use of fewer electrical components, saving on assembly time; the use of single, as opposed to multiple, circuit boards, which increased reliability by reducing contact points and decreased assembly time; greater automation in the construction of circuit boards; more extensive levels of vertical integration (the major Japanese producers make their own integrated circuits and have close working relationships with their suppliers, helping them lower component counts); and more efficient board designs. These factors reduce labor, material and inventory requirements.

TABLE 5

MACHINERY AND EQUIPMENT INVESTMENT AS A SHARE OF GDP AND AVERAGE ANNUAL GROWTH IN MANUFACTURING EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(Percent)

	Machinery and Equipment Investment				Employment				Productivity				Real Wages			
	68/60	73/68	79/73	85/79	68/60	73/68	79/73	85/79	68/60	73/68	79/73	85/79	68/60	73/68	79/73	85/79
U.S.	6.7	7.3	8.0	8.0	2.3	0.2	1.1	-1.2	3.2	3.8	0.9	3.5	1.6	1.2	0.0	-0.7
Canada	7.3	7.1	7.7	7.4	2.8	2.1	1.5	-0.5	3.9	4.4	1.0	1.3	2.3	3.6	2.2	-0.2
Japan	—	14.4	10.8	10.2	4.1	2.0	-1.3	1.4	9.0	10.4	5.0	6.3	5.2	9.7	1.6	1.4
Germany	9.2	8.9	7.9	8.2	0.3	0.9	-1.4	-1.6	4.7	4.5	3.1	2.4	4.3	5.2	2.5	0.4
France	9.6	9.7	9.5	9.5	0.5	2.1	-0.9	-2.3	6.8	5.8	3.9	2.5	4.0	5.3	3.7	1.2
U.K.	8.5	8.7	8.8	8.0	-0.3	-0.9	-1.3	-4.5	3.4	3.8	0.6	3.7	—	3.7	0.9	2.3
EC	9.1	9.0	8.5	8.2	0.5	0.6	-1.0	-2.4	5.1	5.5	2.7	2.9	—	—	2.9	1.2

Source: OECD, *Historical Statistics 1960–85* (Paris, 1987).

productivity growth has exceeded growth in Europe but still lags behind Japan's performance.

	Machinery and Equipment Investment as a Share of GDP		Average Annual Mfg. Productivity Growth	
	1979/1973	1985/1979	1979/1973	1985/1979
United States	8.0%	8.0%	0.9%	3.5%
Canada	7.7	7.4	1.0	1.3
Japan	10.8	10.2	5.0	6.3
Germany	7.9	8.2	3.1	2.4
EC	8.5	8.2	2.7	2.9

U.S. and Canadian performance for the total economy continues to be somewhat behind progress in Japan and the EC because of stronger performance in the agricultural sectors of many EC countries and better performance in the Japanese and German service sectors.

Average Annual Productivity Growth, 1973–85

	Agriculture		Services		Total Economy	
	1979/1973	1985/1979	1979/1973	1985/1979	1979/1973	1985/1979
United States	1.1%	4.3%	0.1%	0.5%	0.0%	1.1%
Canada	−0.7	2.1	2.5	0.7	1.3	1.0
Japan	0.9	3.0	2.2	1.3	2.9	3.0
Germany	4.8	3.5	2.0	1.3	2.9	1.6
EC	4.0	5.1	1.6	0.3	2.3	1.5

Moreover, now that U.S. manufacturing has reduced the gap with its Japanese competitors in many management areas, can U.S. manufacturing continue to improve productivity performance without substantial increases in the share of GDP devoted to investment?

On the positive side, the number of young people entering the North American labor force is declining; the portion of more mature and more skilled workers will be rising through the end of the century. Conversely, an emerging area of concern (discussed in Chapter 3) is the difficulty North American companies are encountering in achieving the same results as their Japanese competitors in the use of new manufacturing

technologies, such as computer-aided manufacturing. These technologies often require important adjustments in organizational structures and human resource development to be effectively implemented.

Slower U.S. and Canadian productivity growth will cause a slowdown in the growth of real incomes and, in the absence of exchange rate adjustments, declining cost competitiveness in export and import-competing industries. To the extent that exchange rate movements compensate for differential rates of productivity growth, U.S. and Canadian cost competitiveness can be maintained but at the expense of North American incomes growing more slowly than those enjoyed in Europe and Asia.

From 1973 to 1986 real wages in the United States fell about 0.7 percent a year, while in Canada their progress slowed from more than 4 percent a year from 1949 to 1973 to less than 2 percent a year. In 1960 North American manufacturing compensation was three to four times higher than in northern Europe, and the gap was even wider with respect to Japan. By 1970 these differentials had been cut. After the devaluations of the U.S. dollar in 1971 and 1973, the U.S. wage differential with Germany was about 11 percent, and Germany had surpassed Canada.

Comparative Compensation Levels in Manufacturing

	1960	1970	1973
United States	100	100	100
Canada	77	79	86
Germany	30	55	89
Japan	10	23	42

From 1973 to 1980 exchange rates generally adjusted for slower North American productivity growth, and German wage levels exceeded both U.S. and Canadian levels, while Japanese wages continued to lag. By 1985 the appreciation of the U.S. and Canadian dollars against other currencies raised North American wages above compensation elsewhere. However, with the recent decline of the U.S. and Canadian dollars, the wages of North American manufacturing workers have fallen substantially behind those of workers in Germany and are not much above those of workers in France and Japan.[3]

3. It is also interesting to note that wages in Hong Kong, Singapore, Taiwan, and Korea today appear to be slightly higher than those in Japan in 1960, indicating that current wage advantages in those countries should by no means be viewed as permanent; see Table 4.

Comparative Compensation Levels in Manufacturing

	1980	1985	1987 (est.)
United States	100	100	100
Canada	85	86	88
Germany	125	74	122
Japan	57	50	84
France	91	58	90

The large North American current account deficits[4] experienced in recent years indicate that 1987 exchange rates and wage comparisons are much closer to sustainable levels than 1985 levels. These wages may permit improved North American trade balances but exact slower growing standards of living than attained elsewhere. When evaluated in terms of productivity growth or the progress of sustainable real incomes, U.S. and Canadian national competitiveness has declined relative to progress in other AICs.

With U.S., Canadian, Japanese, and German productivity and wages converging, North American productivity performance must match Japanese and European progress for North American wages and living standards to keep up with wages and living standards elsewhere.

4. Combined U.S.-Canadian deficits with the rest of the world.

3

Industry Competitiveness

Determinants of Industry Trade Performance

Productivity performance tells a great deal about long-term prospects for national competitiveness—about sustainable real wages and incomes. At the industry level, though, a country cannot be a net importer or exporter of all goods and services, regardless of how overall productivity compares with other countries. A nation tends to specialize in products it makes relatively more efficiently and less expensively than its trading partners.

Italy exports shoes to and imports machinery from the United States not because its shoe industry is necessarily more productive than the U.S. shoe industry. Rather, Italy exports shoes because the ratio of output per worker in Italy's shoe industry to output per worker in the machinery industry is greater than the same ratio for the U.S. shoe and machinery industries.

Measured in terms of absolute output per worker, both the U.S. shoe and machinery industries may be more efficient—overall manufacturing productivity in the United States is about 35 percent greater than in Italy. As exchange rates adjust to compensate for this overall (average) productivity gap, U.S. workers should earn higher wages, and average costs across all manufacturing tend to equalize between the two countries. When this happens, the relative cost effectiveness of Italian shoemakers, machinery makers and producers in other industries becomes critical in determining what Italy sells to the United States.

When exchange rates do not adjust to achieve balanced trade, or the international constellation of national monetary and fiscal policies does not permit such exchange rate adjustments, the effects of these relationships on trade become distorted. For example, if the lire is undervalued, Italian import-competing industries, such as machinery, capture greater shares of domestic markets and displace U.S. exports; meanwhile, Italian export industries, such as shoes, capture greater shares of U.S. and other foreign markets. Italy's international competitive weaknesses become understated and its strengths overstated. The converse would be true if the lire becomes overvalued.

We may then define a country's industry or comparative competitiveness in terms of products in which it would be a net exporter or net importer under exchange rates and foreign and domestic monetary and fiscal policies that promote cyclically balanced trade.

Such comparative competitiveness is determined by two sets of factors:

- Structural factors—national supplies of physical and R&D capital, natural resources and various types of skilled labor, including the amount and quality of education and training they receive. These determine prices that businesses must pay for inputs and what economists call comparative advantages. General taxing and spending policies can importantly affect how fast supplies of these resources grow.
- More focused government policies—national industrial and trade policies intended to protect the jobs and wages of particular groups of workers, support production in declining industries or encourage emerging industries.

The availability of domestic resources has been found to be an important determinant of industry competitiveness (for example, see Stern, 1975; Stern and Maskus, 1981; and Baldwin, 1971 and 1979). However, the role of government policies should also be considered in selected industries. The rest of this chapter examines how rapidly growing supplies of key productive resources outside North America, as well as government policies, have significantly changed competitive prospects for U.S. and Canadian industries.

Changing Competitive Opportunities for U.S. Industry

The United States is particularly well endowed in agricultural land, highly educated skilled labor and R&D capital. The internationalization of the U.S. economy during the 1970s was accompanied by an expectation among economists and policymakers that the United States could pay for more imports of energy, other natural resources and basic manufactures with increased exports of agricultural commodities, services and high technology manufactures, which make intense use of America's abundant resources. However, these expectations have been frustrated by a combination of shifts in comparative advantages, foreign and domestic government policies and, in the case of high technology, special circumstances that have appeared at times to challenge the relevance of concepts such as comparative advantage.

Agriculture

During the early 1970s substantial increases in world grain prices and in sales to the Soviet Union gave rise to optimism about the role farm products could play in expanding U.S. exports. For example, grain prices increased dramatically from 1972 to 1973, as did the volume of export sales, and agriculture's share of U.S. exports jumped from 18 percent to an average of 24 percent in 1973 and 1974. However, for the rest of

the decade, this share declined. In 1980 agriculture accounted for just 19 percent of U.S. exports, and by 1986 it had declined to only 12 percent.

Why have U.S. farmers lost significant market share internationally? The answer lies in a combination of changing supply conditions and government policies abroad and at home. Together they have reduced global prices for commodities and the ability of U.S. farmers to compete at those prices. On the supply side, genetically based improvements in agricultural technology have increased productivity in many middle income developing countries. Moreover, many of these countries have abandoned development strategies that systematically penalized rural areas and farming to promote industry. These changes in technology and policy have reduced the demand for basic commodities in international markets (e.g., Indonesia, once the world's largest importer of rice, is now self-sufficient), and they have created new exporters (e.g., India in wheat). Reduced demand and increased foreign sources of competitive supply translate into reduced comparative advantages for American farmers. In addition, these problems have been exacerbated by misguided government policies in Europe and Japan, and in the United States. The EC subsidizes exports, artificially elevating global supplies; Japan restricts market access, artificially suppressing international demand. Both sets of policies depress international prices and limit U.S. export opportunities. Moreover, U.S. support prices (both target and loan rates) for grains and oil seeds have been above world prices, critically reducing U.S. export potential in a tougher competitive environment. The overvalued U.S. dollar exacerbated these problems.

Services

The competitive position of U.S. service exports has not changed dramatically in recent years. For the past 15 years, service exports (excluding interest and dividends) have been about 12 to 15 percent of total U.S. export receipts (goods, services and interest and dividends). Tourism and transportation services tend to dominate. Private business services and fees and royalties contribute only about one-third of service receipts. Substantial growth in business service exports is limited by foreign trade barriers that are not generally covered by the GATT. Such barriers sometimes emerge from seemingly benign differences in the ways national governments regulate their service industries, but they also reflect more direct discrimination. Barriers to trade in services will be more difficult to eliminate than barriers to trade in goods, as solutions will require far-reaching changes in domestic regulatory practices and legislation. Moreover, liberalizing trade in services often requires concessions in areas usually relegated to negotiations concerning foreign investment—notably right of establishment and national treatment—

TABLE 6

TECHNOLOGICAL KNOW-HOW BALANCE OF PAYMENTS, 1973 AND 1983
(Payments and Receipts for Patents, Licenses, etc.;
Mill. 1975 $ and Percent)

	Receipts, 1973 (Exports)		Payments, 1973 (Imports)	
U.S.	$3582.6	65.7%	$ 456.0	9.8%
Japan	231.2	4.2	1035.7	22.2
Germany	222.8	4.1	618.4	13.3
France	328.3	6.0	476.5	10.2
U.K.	647.2	11.9	552.7	11.9
Canada	45.3	0.8	188.7	4.0
Total OECD	5456.6	100.0	4660.6	100.0
	Receipts, 1983		**Payments, 1983**	
U.S.	$4328.6	59.4%	$ 132.2	2.8%
Japan	645.9	8.9	748.9	16.0
Germany	365.1	5.0	728.7	15.6
France	557.7	7.6	617.8	13.2
U.K.	650.7	8.9	510.1	10.9
Canada	122.1	1.7	260.2	5.6
Total OECD	7290.7	100.0	4679.5	100.0

Source: Stanley Woods, *Western Europe: Technology and the Future* (Paris: Atlantic Institute, 1987), Table 3.7.

owing to the needs of many service firms to set up offices and subsidiaries in foreign countries to export abroad effectively. The U.S.-Canadian trade agreement addresses these kinds of problems and should permit a significant increase in bilateral service flows. However, while services are on the agenda for the Uruguay Round, multilateral progress will be slow.

It is important to note that many of the factors contributing to competitiveness in technology-intensive manufacturing are also important in services. For example, much of earnings from patents and royalties flows from inventions in high technology manufacturing and from the creative energies of performing artists. Leadership in information technology is tightly connected to leadership in computers, microelectronics and telecommunications. Table 6 shows exports (receipts) and imports (payments) of technological information (e.g., patents, royalties) for OECD countries. The United States is the largest exporter; however, its market share is declining. Moreover, from 1973 to 1983 Japan increased its market share the most among the AICs (4.2 to 8.9 percent), followed by France (6.0 to 7.6 percent). As discussed below, these two countries also improved their trade competitiveness vis-à-vis the major AICs in technology-intensive manufacturing.

Staying competitive in these export industries and others, such as investment and commercial banking, insurance, and construction and

engineering, requires well-trained, highly educated, internationally aware, and culturally sensitive employees. As the quality of the Japanese and NICs' labor forces continues to improve and their manufacturing achievements in more technology-intensive areas provide the necessary supporting experience, the United States may expect to encounter much more intense competition from Japan and subsequently from other East Asian nations. Japan is already demonstrating its ability to make the transition from goods to services in banking and construction and engineering. South Korea is quite competitive in construction and engineering, and U.S. firms are losing ground in that industry (Office of Technology Assessment, 1987).

High Technology

U.S. trade balances in R&D-intensive products from 1960 to 1980 are shown in Figure 3. Until the overvalued dollar drove these balances down, trade balance data of this kind—along with computations showing value added, employment and capital growing more rapidly in U.S. R&D-intensive industries than in other U.S. manufacturing—were cited as evidence of a strong and improving U.S. comparative advantage in high technology industries (for example, Lawrence, 1984).

While on the surface Figure 3 may indicate an improving competitive position, such an upward trend for simple trade balances can reflect the effects of inflation and general economic growth as much as changes in competitive position. What is important are the relative growth rates for imports and exports. To correct for these factors, the annual data for U.S. trade balances in R&D-intensive goods used to construct Figure 3 should be normalized to remove the effects of inflation and growth. One way to do this is to divide these annual trade balance data by the annual values of total R&D-intensive imports plus exports. The results of these computations are given in Figure 4.[1] They indicate that U.S. competitiveness in high technology industries was declining well before the dollar began appreciating in 1981.

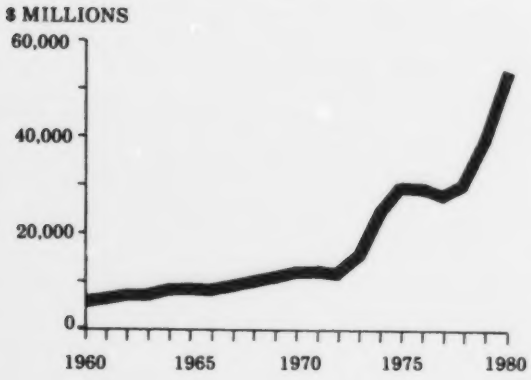
Furthermore, the rapid growth of value added in these U.S. industries does not necessarily indicate a strengthening competitive position for U.S. producers if the same is taking place in other AICs. Technology-intensive industries were also growing rapidly in Japan, France, Germany, the United Kingdom, and Canada (Mutti and Morici, 1983—data updated for this study).

1. An alternative normalized measure of competitiveness is the export-import ratio—it also demonstrates a decided downward trend.

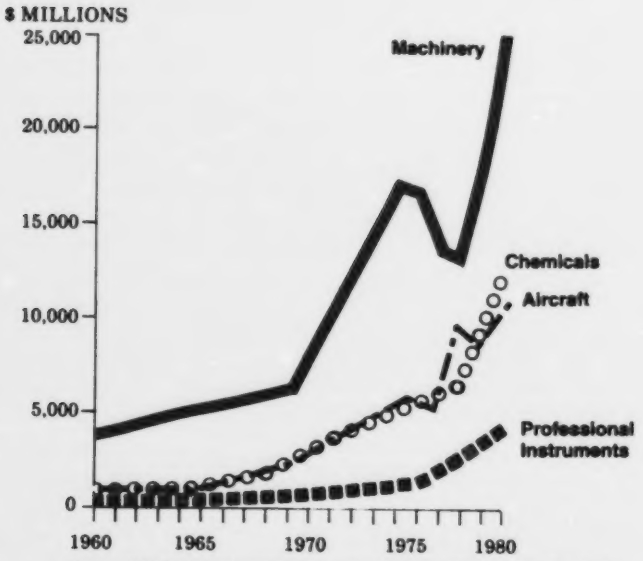
FIGURE 3

U.S. TRADE BALANCE IN R&D-INTENSIVE MANUFACTURES, 1960–80

A. All R&D-Intensive Manufactures



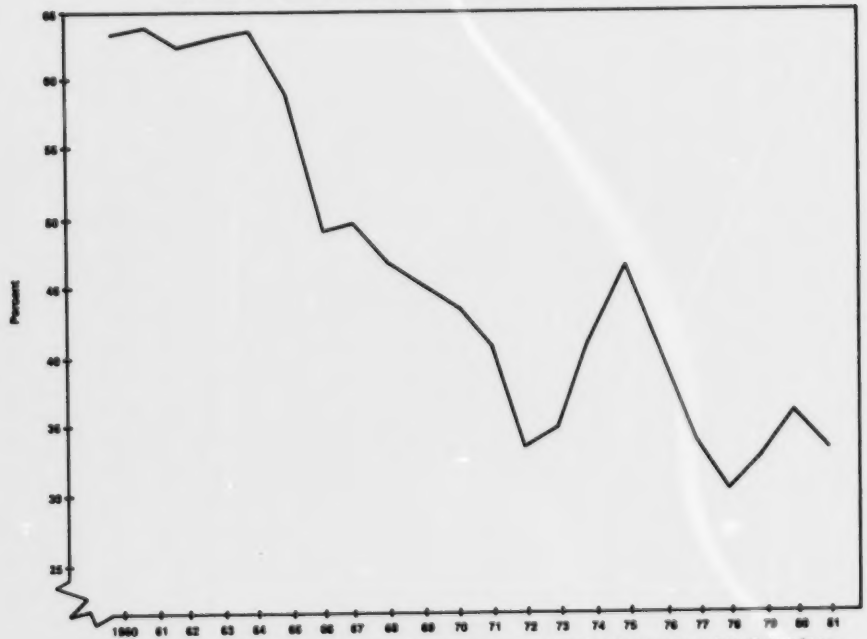
B. Selected R&D-Intensive Product Groups



Source: U.S. Trade Representative, *Twenty-sixth Annual Report of the President of the United States on the Trade Agreements Program: 1981–82* (November 1982), Figures 14 and 15, pp. 26 and 29, reproduced.

FIGURE 4

U.S. TRADE BALANCE IN R&D-INTENSIVE PRODUCTS
DIVIDED BY R&D-INTENSIVE EXPORTS PLUS IMPORTS, 1960–81



Sources: Derived from U.S. Trade Representative, *Twenty-sixth Annual Report of the President of the United States on the Trade Agreements Program: 1981-82* (November 1982), Table A-14, page 156; and National Science Foundation.

Shares of Manufacturing Value Added, Technology-Intensive Sectors

	U.S.	Japan	France	Germany	U.K.	Canada
1969	44%	40%	34%	41%	39%	30%
1981	47	54	41	46	43	32
1985	47	60	42	49	44	32

These industries expanded most in Japan, France and Germany; the former two countries were found to be improving their trade performance vis-à-vis the United States and the other major AICs.[2]

International Competitiveness in Technology-Intensive Sectors
(Export-Import Ratios)

	U.S.	Japan	France	Germany	U.K.	Canada
1969	1.78	3.41	1.13	3.04	3.16	0.78
1981	1.56	7.38	1.24	2.42	1.43	0.82
1985	0.75	6.67	1.22	2.19	1.04	0.81

Focusing on production, the comparisons between the United States and Japan were fairly robust across all the technology-intensive sectors studied.

Shares of Manufacturing Value Added, Technology-Intensive Sectors

	U.S.			Japan		
	1969	1981	1985	1969	1981	1985
Transport equipment	13.4%	10.4%	11.7%	8.8%	11.9%	10.1%
Electrical equipment	8.2	9.5	10.0	9.6	14.6	21.1
Professional goods	3.0	3.3	2.9	1.3	4.3	5.0
Machinery, n.e.c.	11.0	12.5	12.0	11.3	13.0	14.0
Industrial chemicals	4.0	5.2	5.0	5.1	4.7	4.3
Other chemicals	4.4	5.6	5.7	3.5	5.3	5.2
Total	44.0	46.5	47.3	39.6	53.8	59.7

2. Declining trade performance through 1981 is a more reliable indicator of eroding U.S. competitiveness than observations for subsequent years. This was the last year the U.S. current account was near balance and unaffected by large federal budget deficits and a strong dollar.

TABLE 7

INTERNATIONAL COMPETITIVENESS IN HIGH TECHNOLOGY INDUSTRIES, 1970–84
(Export-Import Ratios)

	U.S.	Japan	France	Germany	U.K.	Canada
1970	2.14	2.36	0.94	1.69	1.38	0.65
1971	2.11	2.84	1.03	1.72	1.50	0.69
1972	1.70	3.13	0.97	1.77	1.38	0.65
1973	1.79	3.00	0.97	1.88	1.19	0.58
1974	2.02	2.68	0.94	1.89	1.19	0.52
1975	2.75	3.03	1.06	1.62	1.32	0.54
1976	1.82	3.84	1.06	1.65	1.30	0.64
1977	1.69	4.12	1.10	1.59	1.29	0.63
1978	1.68	4.67	1.17	1.62	1.29	0.72
1979	1.86	3.85	1.20	1.53	1.21	0.71
1980	1.95	4.07	1.05	1.48	1.31	0.72
1981	1.79	4.64	1.06	1.38	1.19	0.72
1982	1.68	4.50	1.10	1.47	1.16	0.78
1983	1.45	4.66	1.14	1.38	1.02	0.73
1984	1.10	5.12	1.21	1.41	1.00	0.74
1985	1.06					
1986	0.97					
1987 (1st half)	1.03					

Source: Computed from data provided by the U.S. Department of Commerce.

Analyzing other trade data, Aho and Rosen (1980) and Hatter (1985) support these basic conclusions. For example, Hatter concluded:

> Although the United States remains by far the leading exporter of high-technology manufactures, the decline in our market share shows that other nations, particularly Japan, are increasingly competitive with the United States in this vitally important manufacturing sector.
>
> Japan's share of the industrial countries' exports of high-technology products more than doubled between 1965 and 1982 to reach 17.3%. In 1981, Japan replaced Germany as the second leading exporter of high-technology products. Japan dominates the export market for communications equipment and electronic components.

Hatter's analysis is particularly noteworthy because her definition of high technology trade was more precise than Mutti and Morici's. These authors were constrained by their effort to construct a consistent trade and production (value added) data set for six countries to study rather broad industries. Hatter analyzed only trade data and was therefore able to comb more finely for R&D-intensive activities. Applying Hatter's data, therefore, to measure changes in competitiveness:

International Competitiveness in Hatter's High Technology Industries
(Export-Import Ratios)

	U.S.	Japan	France	Germany	U.K.	Canada
1970	2.14	2.36	0.94	1.69	1.38	0.65
1981	1.79	4.64	1.06	1.38	1.19	0.72
1984	1.10	5.12	1.21	1.41	1.00	0.74

Again, Japan and France improved their competitiveness in high technology industries, while the United States, Germany and the United Kingdom did the opposite (see Table 7).

Why did the U.S. competitive performance decline vis-a-vis Japan and France? Was it caused by shifts in comparative advantages? Predatory industrial and trade policies? Both? There is evidence supporting each view.

Focusing on Japan, Saxonhouse (1983 and 1985) constructed a rather sophisticated model of Japanese trade performance and concluded that Japan's trade patterns generally lie within those expected on the basis of classical economic concepts of comparative advantage, indicating that MITI's efforts to orchestrate industrial development are superfluous. Borrus and Zysman (1985) challenged this basic conclusion. They argued that Saxonhouse failed to explain why Japan, unlike the other AICs, does not import much in the manufacturing industries in which it exports—i.e., Japan does not participate much in interindustry trade, which has become quite important in trade among the other AICs.

Mutti and Morici argued that shifts in underlying comparative advantages are most important but that industrial policies also play a role. Specifically, the United States appears to have the largest supply of research scientists and engineers per worker employed. Yet Japan has been adding to its supply so rapidly that its R&D efforts are now almost equal to those of the United States. (Similarly, other countries are closing

TABLE 8

R&D SCIENTISTS AND ENGINEERS, MAJOR INDUSTRIAL COUNTRIES

	1984 Number per Thousand in Labor Force	1965–84 Average Annual Rate of Growth
U.S.	65	0.1
Canada	30	2.4
Japan	62	5.0
France	41	3.6
Germany	49	4.1
U.K.	34	3.0

Source: National Science Foundation and OECD Science and Technology Indicators data base.

their gaps with the United States—see Table 8.) Comparisons of these data to trade performance, though, indicate that improvements in Japanese and French competitive performance may be more rapid than warranted by shifts in comparative advantages and that industrial targeting may be playing a role.

Is High Technology a Special Case?

Why is there so much disagreement? The answer may lie in the special characteristics of some high technology industries that make them especially attractive targets of opportunity for governments wishing to assist in the creation of competitive industries. It is such concerns that underlie the new economic theory of strategic trade policy (targeting)—see Brander, 1987; and Richardson, 1987. Two kinds of industries warrant attention—those with *steep learning curves* and those with room for only a *few competitors.*

A distinguishing characteristic of many high technology industries is that individual firms, as much as countries, are the domiciles and custodians of comparative advantages. A nation's competitiveness is critically determined by the entrepreneurial instincts of individual firms and the buildup of intellectual capital within them—by individual firms' ability to develop a continuous succession of new and marketable products that fulfill needs not easily, or at least not immediately, served by other firms.

Such industries are characterized by short product cycles and *steep learning curves* in actual manufacturing. For new products, market positions are initially exclusive and subsequently shared by only a few firms. This permits firms entering first, or early, to recoup high R&D and product development costs. Once many firms can meet a need, prices can fall quickly as early innovators move rapidly along their production learning curves. Being first, or close to first, is critical if firms are to recoup R&D and product development costs and survive.

Consider semiconductors. Mody and Wheeler (1986) found that the production of successive generations of dynamic random access memory computer chips (DRAMs) exhibits steep learning curves. That is, for each firm, the number of reliable chips produced per silicon wafer etched increases (and the cost per unit decreases) rapidly with cumulative production. Hence, there are real cost and profit advantages to being among the first to introduce a new generation of chips. The learning curve generally begins anew with each generation of chips; however, individual firms have a limited carry-over from one generation to the next. So with each generation of chips, competition among firms begins anew, but successful firms are likely to repeat.

U.S. producers were in this industry first. They introduced early genera-

tions of computer chips before their Japanese competitors. Subsidies and practices limiting Japanese imports helped Japanese firms while they were catching up on learning curves; it is not clear that Japanese firms would have been able to compete so successfully with U.S. companies had Japanese firms not been so assisted.* Certainly the innovative capabilities of Japanese firms were important, but the character of the industry may have created an unusual targeting opportunity for Japanese industrial policy.

Mody and Wheeler found that the learning curve is not standardized across firms—there is variation in how fast new entrants can learn production processes and reduce their costs in making a generation of chips. Industry officials report that the curve is shorter for Japanese firms because of the greater abundance and hence lower wages of young engineers available to the semiconductor industry in Japan than in the United States and the better secondary education and job attachment of Japanese workers. Therefore, now that Japanese firms have a competitive edge, they will prove difficult to dislodge even if the Japanese fully opened their markets. This illustrates the potential noncontemporaneous, enduring effects that strategic trade policy may have.

The costs of developing successive generations of products seem to be growing exponentially, so that within many industries (or at least within important product categories) only a *few competitors* can remain players. The best example may be wide-body jet airliners. In the future, industry analysts suggest that perhaps only two companies will be able to develop and produce wide-body jets. Boeing is a likely winner, and the other principal contenders are McDonnell Douglas and Airbus. Over the next decade, average profits across the three may not be abnormally high, considering the R&D risks involved, but if two clear winners emerge, they could make very substantial profits while the third company could lose a great deal of R&D investment. In this environment, if European government subsidies for the development of the A320, A330 and A340 airliners establish Airbus as the "second manufacturer," then these subsidies could end but their effects endure. Moreover, unlike subsidies to a declining industry whose societal costs generally rise over time and cannot be recouped, "To the extent that subsidies [to Airbus] persuade rival firms to produce less or to stay out of the market altogether, it is possible that the subsidy can more than pay for itself in the form of profits or other rents" (Brander, 1987).

* It is important to note that subsidies coupled with import protection are not the preferred policy choice. Protection increases prices to domestic consumers. Generally, subsidies alone, even if they must be larger in the absence of protection, impose fewer distortions and are more efficient.

The theory of strategic trade policy provides a picture of the kinds of circumstances in which national governments may play a key role in ensuring or accelerating the emergence of an internationally competitive domestic industry. However, it is important to remember that while case studies of individual industries demonstrate that circumstances exist where governments can play a decisive role, such research cannot determine with certainty where temporary subsidies and import protection were critical to the long-term (permanent) success of Japanese or European competitors. Nor does this research indicate that targeting should be a general approach to policy. What the theory and case studies show is that although U.S. competitiveness in high technology activities has been weakened by more rapid growth in R&D activity abroad, U.S. business and government concerns about the effects of foreign subsidies and other forms of targeting may have some empirical basis and should be addressed in international trade negotiations and in the enforcement of U.S. rights under existing trade agreements.

Outlook for U.S. Competitiveness

As a result of lagging U.S. productivity growth, the exchange rate for the dollar vis-à-vis major U.S. trading partners that could balance imports and exports is lower in 1988 than a decade ago. When the U.S. current account is brought back into balance, or into surplus, to service the growing U.S. external debt, a weaker dollar will require Americans to purchase fewer imported products, and they will have to adjust their living standards and life styles accordingly. The longer the United States puts off these adjustments, the more difficult they will be.

For mature U.S. import-competitive industries, we may expect better opportunities in domestic markets. While the United States will continue to be a net importer in most of these sectors, some exports may be expected from them too. For example, Chrysler and Honda are exporting cars from the United States, and U.S. shoe exports are up. However, pressures to improve productivity in these industries mean that while prospects for profits and wages may improve somewhat, unemployment will continue to plague communities dependent on these industries.

Agriculture, services and high technology will remain important in the U.S. export equation, but declining U.S. comparative advantages and obstacles to foreign sales within these sectors also portend increased opportunities for mature industries and manufacturing generally.

Together these trends indicate that if the current account is to be brought back into balance or into surplus in the late 1980s, the structure of U.S. exports and imports may look somewhat different than was anticipated in the 1970s. An improved current account will require not only better performance from export-competing high technology and service industries but also market-supported strengthening of mature

manufacturing industries. All of this suggests a more balanced economy with a greater role for manufacturing, especially mature manufacturing activities, than was expected a few years ago.

How this process plays out will be determined by the success of U.S. management and labor in improving competitive capabilities through increased commitments to innovation and how supportive government policies are to these efforts. Also, how this process plays out will depend on the success of U.S. trade negotiators in obtaining improved market access and fair rules of competition for U.S. exports, especially high technology products and services. The outcome will importantly affect the quality of employment prospects for U.S. workers, U.S. living standards and U.S. international economic leadership.

On the one hand, U.S. trade performance can be improved by shoring up competitive strengths through increased commitments to private R&D in high technology industries, improved productivity in mature industries through the wider dissemination of technological innovation, and assuring market access abroad for U.S. products. On the other hand, a secular decline in the value of the dollar could ultimately lead to balanced export and import growth. The former set of solutions is obviously preferable. It entails controlling U.S. budget deficits, increasing savings and investment, significant changes in the deployment of critical R&D resources, greater attention to human resource development, and the formulation of an effective trade policy. The latter solution would perpetuate slow growing living standards and a decline in the global importance of the U.S. economy.

Changing Competitive Opportunities for Canadian Industry

Historically Canada's competitive strengths have emanated from its substantial endowments of agricultural land and natural resources. It has displayed considerable export strength in grains, fish and food products, forest products, and basic metals and minerals.

During the 1970s, agricultural, energy and other commodity price increases, along with forecasts of global shortages, gave rise to optimism among many Canadian policymakers and economists. Exports of these resources were seen as an engine of continued growth, and rents from the premium prices these products would command were seen as an important source of wealth for encouraging increased downstream manufacturing and for financing government incentives for other industrial activities.

During the 1980s, though, several forces have undermined these assumptions. Along with falling oil prices, the markets for other Canadian resource exports have been weak. Since 1981, export volumes have grown slowly, while prices have generally been flat or have declined, with the exception of forest products.

Prices for Selected Canadian Commodity Exports
(1981 = 100)

	Wheat	Other Farm and Fish	Crude Petroleum	Natural Gas	Metals and Minerals	Sawmill Products	Pulp and Paper	Chemicals and Fertilizer
1981	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1982	92.5	100.3	84.2	106.0	91.0	97.7	96.7	99.3
1983	91.0	97.0	77.5	96.9	92.7	112.1	88.4	96.6
1984	93.2	102.8	79.8	90.3	93.1	111.5	102.3	99.9
1985	93.5	103.2	80.9	75.4	92.0	114.7	102.3	98.8
1986	76.5	100.6	42.4	58.2	94.8	125.1	107.1	92.3
1987	(1st three quarters)							
	60.6	103.6	50.7	46.6	95.4	130.1	117.2	90.2

Source: *Bank of Canada Review,* December 1987.

In agriculture, Canadian farmers face many of the same competitive challenges as their American counterparts. New sources of supply in developing countries, coupled with subsidies in industrialized countries, limit potential export markets and suppress prices.

For many minerals, new technologies and substitute materials have reduced the demand for important Canadian exports—e.g., copper, zinc and lead—and new sources of supply in the developing countries have reduced many Canadian market shares.[3] With many U.S. resource producers facing similar challenges, Canada's problems are further exacerbated by protectionist sentiments in Congress. Actual or threatened loss of access to the U.S. market in forest products, steel and nonferrous metals will remain a major concern for Canada for some time.

These developments have accentuated a three-decade downward trend in the contribution of natural resources to Canadian exports. Specifically, forest products, petroleum and natural gas, minerals, and basic metals accounted for 65 percent of Canada's total merchandise exports in 1960, 47 percent in 1970 and 36 percent in 1984. Much, though not all, of the decline from 1960 to 1970 was caused by the growing importance of automotive products in bilateral trade facilitated by the 1965 Automotive Agreement with the United States. More recently, the primary causes have been the slow growing global demand for resource products and Canada's shrinking shares of these markets.

Turning to secondary manufactures, motor vehicles and parts' portion of Canadian exports has fluctuated significantly but averaged about 23 percent over the past two decades. Meanwhile, other secondary manufactures steadily increased their share from 15 percent in

3. During the resource boom of the 1970s, the World Bank encouraged the development of new mineral supplies in developing countries.

1960 to 19 percent in 1970 to over 25 percent in recent years. This trend reflects a gradual strengthening of Canadian comparative advantages (or a weakening of its comparative disadvantages) in many segments of manufacturing. Supporting this thesis, the *Trade Policy Review* (External Affairs, 1983) presented data showing that the export orientation of many secondary manufacturing industries has risen significantly.

Percent of Canadian Production Exported

	1966–73	1981
Total manufacturing	24.3	30.0
Rubber and plastics	5.0	13.8
Machinery	37.8	54.4
Transportation equipment	60.4	68.4
Electrical equipment	13.0	24.4

Like the United States, a decline in the importance of traditional Canadian export activities portends a more balanced economy and greater apparent self-sufficiency in manufacturing.[4]

Nevertheless, Canadian manufacturing faces many of the same tough challenges as U.S. manufacturing. Canada must expand its R&D infrastructure more rapidly to meet the Japanese challenge; it must enhance and expand the application and dissemination of technology in mature labor- and capital-intensive industries to meet competitive challenges from Latin American and Asian NICs. These tasks are made difficult for Canada for several reasons.

First, in response to the Tokyo Round tariff cuts, rationalization of Canadian manufacturing has continued. However, protection is still important in some sectors, and foreign market access continues to be limited in others. As of 1986, Canadian manufacturing productivity was still about 30 percent below U.S. productivity.

Second, Canada's strong position in natural resources coupled with tariffs and nontariff barriers in other AICs that rose with the level of processing and manufacturing value added helped skew the pattern of Canadian manufacturing development away from human capital-intensive, high technology industries toward more capital-intensive, resource-based manufacturing. The small improvement in its trade performance in technology-intensive industries notwithstanding, Canada's proportionately smaller presence in these activities historically, and con-

4. "Apparent" self-sufficiency has increased since the 1960s in the sense that while the share of Canadian consumption of manufactures supplied by imports within individual industries remains high, the ratios of Canadian shipments and exports to consumption have grown.

sequent smaller R&D infrastructure, makes it harder for Canada than for the other major AICs to put greater emphasis today on high technology exports. It is important to note that of the six major competitors in Table 8 (p. 29), Canada ranks last in the number of scientists and engineers per thousand workers; Japan, Germany, France, and the United Kingdom have expanded their R&D efforts more rapidly than Canada.

As a result of these disadvantages, Canada needs to improve productivity in many mature industries through continued rationalization and investment in new capital and technology, not only to meet NIC competition but also to bring these industries up to U.S. productivity levels. Similarly, Canada must increase its capabilities in high technology activities, but it begins in a less advantageous position than the United States. To encourage the private sector to undertake these adjustments, Canada needs to obtain assured access to a large affluent market and to remove the remaining elements of protection afforded its industry. The logical course, for both its mature and emerging industries, is to achieve assured free access to the large U.S. market. Furthermore, Canada needs to secure continuation of the access it has already achieved for its highly efficient resource-based manufacturing industries such as nonferrous metals and to regain access recently compromised in areas such as forest products.

Strengthening North American Manufacturing

As the United States and Canada move toward more balanced economies, the competitive performance of many manufacturing sectors will improve. As already noted, the critical question is how—through a secular decline in the foreign exchange values of the U.S. and Canadian dollars or through more rapid and frequent product innovations and quality improvements, and increased productivity growth?

Investing in R&D

In high technology industries, the need for more R&D investment in the face of growing Japanese and European efforts is apparent. More rapid growth in the number of research scientists and engineers in Japan and Europe indicates faster growing stocks of R&D capital abroad and the potential for increased market penetration by foreign competitors.

As noted above, part of Canada's lower level of R&D activity may be attributable to the traditional resource orientation of Canadian industry. However, as Canadian business seeks to emphasize exports of state-of-the-art machinery, electrical equipment, advanced chemicals, and other secondary manufactures, the availability of trained scientists and

engineers and increased business investment in R&D will become critical. With substantially fewer researchers employed in Canada than in other countries, its universities will have to expand their capacity significantly to train scientists and engineers.

For the United States, the allocation of available R&D resources is a critical public policy question. Its R&D spending of 2.8 percent of GNP is about as much as its principal rivals, Germany and Japan, and more than other countries. However, federal policies are affecting the commercial benefits derived from these efforts.

About half of U.S. R&D spending is government (mostly federal) financed—a much larger share than in Japan and Germany where the private sectors spend more.

R&D Spending as a Share of GNP, 1985

	Public	Private	Defense	Nondefense	Total
United States	1.4%	1.4%	1.0%	1.8%	2.8%
Japan	0.6	2.2	*	2.8	2.8
Germany	1.0	1.7	0.1	2.6	2.7

*Less than one-half of 1 percent.
Source: Science and Technology Indicators data base.

U.S. government-sponsored R&D has been primarily mission oriented (mostly defense and space exploration), justified in terms of broad societal objectives rather than in commercial goals or the basic advancement of science. Although there have been important commercial spinoffs, these usually were unplanned or were only secondary objectives.[5]

U.S. federal funds generally have not been used to encourage coordination of private R&D efforts that might accelerate the development of new, more competitive products, and U.S. antitrust laws have discouraged cooperation among private sector firms. The Microelectronic Computer and Technical Corporation, which brings together several computer and electronics companies, and President Reagan's proposed program for superconductors are examples of exceptions rather than the rule and are in strong contrast to MITI's efforts in Japan.

Government-funded R&D in the United States does raise the productivity of privately financed R&D; however, the commercial benefits can

5. This is in sharp contrast to many Japanese and European government efforts, such as MITI's programs in computers, new materials and fiber optics, and European support for Airbus, Espirit and Eureka. There have been important exceptions. For example, in the computer sector, where threatened loss of commercial leadership has been interpreted as potentially impairing the U.S. defense industrial infrastructure, the U.S. government has responded on occasion, e.g., the Very High Speed Integrated Circuit Program in 1978 (Flamm, 1987).

accrue to foreign as well as domestic firms. While the commercial benefits of U.S. government-financed R&D should be more appropriable by U.S. firms than by foreign firms, this R&D may create fewer competitive benefits exclusively for U.S. firms than privately financed R&D, especially given the openness of the U.S. system.

The consequences for U.S. competitiveness of greater emphasis on public, noncommercial and semicommercial R&D are further exacerbated by the increasing defense-related share of federal R&D spending. Defense-supported R&D has led to major commercial applications in semiconductors, computers and commercial aviation. However, as high technology industries have matured, defense and commercial applications have tended to diverge. In recent years this has limited somewhat the commercial applicability of defense research. In some (but not all) industries, spinoffs may now run more from commercial to military applications than the opposite. For example, according to an industry official working with the Defense Public Advisory Committee on Trade: "Military aircraft and weapons programs used to lead to civilian versions, but the trend is shifting in the opposite direction" (*Aviation Week and Space Technology,* November 24, 1986).

Also, U.S. security restrictions on exports of defense-related merchandise can adversely affect the commercial benefits derived by U.S. firms when: complementarities are present between defense and civilian applications, the United States does not have a monopoly in products subject to controls, and U.S. approval processes are cumbersome. In 1987 a Joint Committee of the National Academy of Sciences, the National Academy of Engineers and the Institute of Medicine—the Committee on Science, Engineering and Public Policy (1987)—found U.S. export review procedures to be longer in the United States than elsewhere. In an extreme example:

> In March 1983, a U.S. company sought a license to export a $450,000 nuclear magnetic resonance spectrometer to a medical research institute in Eastern Europe. The application was not approved until November 1985. Although U.S. firms pioneered the development of NMR, German and Japanese companies now hold two-thirds of the world market for such instruments. During the review period in Washington, a German competitor sold several similar NMR systems to Communist Bloc customers. The NMR instruments do not appear on the U.S. control list but the equipment was subject to licensing because it contained 32-bit array microprocessors and 30-megabyte Winchester disk drives (*Science*, March 1987).

This line of discussion should not be taken as an argument against defense R&D; rather it indicates that defense R&D should not be expected to substitute for nondefense R&D on a dollar for dollar basis.

With Japan and Germany spending about the same shares of GNP

on R&D as the United States but with larger shares being financed by their private sectors, improved U.S. competitive performance will require increased business commitments to R&D and better management of public efforts.

As important as increased R&D efforts and product innovation are to competitiveness in high technology, the diffusion of new technologies and the effective organization of manufacturing and management of human resources to take full advantage of these are critical to improving productivity and quality across the full range of manufacturing. Research undertaken for the National Academy of Sciences and at the Harvard Business School indicates that these are emerging as important problem areas for U.S. manufacturing and hence for their subsidiaries in Canada.

Diffusion of Technology

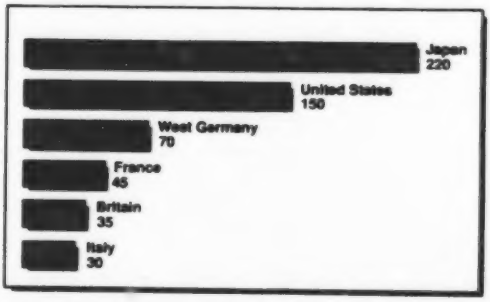
North American manufacturers appear to be lagging behind Japan in implementing new automation and flexible manufacturing technologies. The close link between the availability of new capital and the adoption of new methods makes lower levels of U.S. and Canadian investment in new machinery and equipment (see Table 5, p. 16) a general indicator of this lag. More important, industry studies indicate that U.S. firms lag behind competitors in Japan, Sweden and West Germany in the adoption of innovations such as robotics and computer numerically controlled (CNC) machines (Flamm, 1986; and Mowery, 1986). Also, Jaikumar estimated in 1986 that over the previous five years Japan outspent the United States on automation by two to one; he estimated that 55 percent of the machine tools purchased in Japan were for CNC machines, while the comparable figure in the United States was 18 percent. Forecasts for the number of flexible manufacturing systems that will be in place in 1990 indicate a significant lag in the United States (see Figure 5).

The evening of technological capabilities among Japan, the United States, Canada, and other AICs has shortened or eliminated U.S. leads in many areas, and the rate of diffusion of technology among countries appears to be accelerating. Foreign innovations are becoming a more important potential source of new processes for American manufactures. Yet the National Academy of Sciences, Panel on Technology and Employment (1987), found that U.S. firms "do too little to gain access to foreign science and engineering research, despite the importance of these 'offshore' sources of commercial technology."

The same cannot be said about key foreign competitors, and the panel concluded it is "imperative that U.S. firms emulate those of other nations, such as Sweden and Japan, and monitor the international technological

FIGURE 5

ESTIMATED NUMBER OF FLEXIBLE MANUFACTURING SYSTEMS IN USE BY 1990



Source: Nicholas Valery, "Factory of the Future," *The Economist* (May 30, 1987), p. 10; reprinted by permission.

environment assiduously to remain abreast of new developments and research."

Corporate Structures and Human Resource Management

The advent of new technologies can strongly influence "best practices" for the integration and organization of corporate functions. For example, in implementing computer-integrated production of lawn and garden tractors, Deere and Company achieved considerable savings by redesigning a single component so that it could be used in eight different tractors. IBM achieved comparable gains by simplifying the design of desktop printers—printers designed for quick assembly with automated equipment can even be manually assembled in less than three minutes (National Academy of Sciences, Panel on Technology and Employment, 1987). Westinghouse officials estimate that up to 25 percent of the gains from automation can come from merely redesigning products for easy assembly by automated assembly equipment, apart from actually installing the machinery (Sadlow, 1987). However, this integration of design and production engineering systems, which traditionally have been in separate departments, can entail major organizational changes.

On a broader level, computer-integrated manufacturing seeks to coordinate many functions—marketing, product specification and design, fabrication and assembly with flexible manufacturing systems, materials purchasing, and inventory control—to facilitate quick, flexible and cost

effective responses to changing customer requirements and market conditions. Efficient use of these systems requires that decisions "once made by people in functions that were relatively independent must now be made jointly" (National Research Council, Committee on the Effective Implementation of Advanced Manufacturing Technology, 1986).

The organization of North American companies and manufacturing processes has been heavily influenced by the production line, or transfer line, concept perfected earlier in this century. Large firms typically had strong central management control. Middle managers and professionals were specialized and compartmentalized by function, e.g., product development and production engineering were often separate functions, as were strategic planning, marketing, public relations, and purchasing. On the production line, efficient manufacturing emphasized breaking down tasks into a series of relatively unskilled, repetitive activities. Narrow job classifications permitted companies "to rely on lower-level managers, rather than workers, to make decisions" (National Academy of Sciences, Panel on Technology and Employment, 1987).

The effective use of new computer-integrated technologies entails collapsing serial functions into a more simultaneous process. As in the combination of design and manufacturing engineering, the integration of processes can be productive quite aside from the actual installation of the new equipment. This may be why large companies are increasingly producing a broad range of products by turning to organizational units that integrate marketing, product design, manufacturing, and sales functions by product line. Examples include highly successful reorganizations at Kodak and Champion International.

The implications of computer-assisted manufacturing for the roles of production workers are equally important. Many functions of supervisors—planning, scheduling work and diagnosing problems—will be taken on by assembly workers in "work teams." With numerous new systems, managers and engineers cannot fully anticipate potential production problems; assembly workers are in a key position to recognize them before machines shut down, thereby avoiding expensive delays, and to advise management in the design of new systems and the purchase of equipment. These technologies also require workers to take on greater responsibility for the quality and speed of production and for managing their own work; workers will need better basic skills, more technical training and continuous retraining. "The knowledge requirements and responsibilities of production workers may well come to resemble those of engineers, who have long recognized the need for constant upgrade and 'brush-up' training to keep up with changes in their fields" (National Academy of Sciences, Panel on Technology and Employment, 1987).

Firms will thus have to invest more in technical training for production workers to gain the full benefits of computer-assisted manufactur-

ing systems. For example, GM's new automated front axle plant in Saginaw, Michigan, will be run entirely by robots during part of each working day. The plant will be operated by 40 UAW workers with more than a year of training in electrical, mechanical and problem-solving skills (Hoerr and Pollock, 1986). This amount of training is relatively uncommon in the United States but not in Japan. In his study of 60 flexible manufacturing systems in Japan and 35 in the United States, Jaikumar (1986) found that 40 percent of the workforce in Japanese companies were college trained engineers, and all had training in the use of CNC machines. Only 8 percent of U.S. employees were comparably trained engineers, and less than 25 percent had been trained in CNC machines. Jaikumur found that Japanese companies were getting more from their investments in flexible manufacturing systems.

A good example of the synergism that can be achieved between computer-assisted manufacturing and work team organizations is the 830-employee Westinghouse furniture systems plant in Grand Rapids, Michigan. Worker participation in a system of committees and task forces ranges from discussions of overall business strategy to efforts to redesign work areas for improved productivity. By employing computer-aided design and manufacturing, the plant can move from one special order to another, combining standardized parts in unlimited permutations. From 1983 to 1986 productivity rose 74 percent. The factory functions more like a quick-response service establishment than a traditional factory.

> Shop floor workers consult frequently with customers who phone or visit the factory to check on the progress of their orders. As in a top-quality French restaurant, everything is aimed at pleasing the customer, including high product quality and short delivery time. Michael Maccoby, a pioneer consultant on work reform, says the Westinghouse plant is a leading example of a "technoservice" mode of production that is replacing the old "industrial bureaucracy" systems that crank out unvarying, mass-produced items. To become competitive, Maccoby says, companies must "get away from the bureaucratic industrial mentality which is oriented to output, not to quality or the customer" (Hoerr, 1987).

Despite the potential benefits of combining changes in organizational structures and labor-management relations, increased training for production workers, and new manufacturing technologies, qualitative and anecdotal evidence suggests that U.S. industry may be insufficiently attentive to the need to reorganize work processes (National Academy of Sciences, Panel on Technology and Employment, 1987). Japanese competitors are more comfortable using these approaches to corporate organization and human resource management. Nevertheless, North American models are emerging of how to implement and combine "best practices" management and organization with state-of-the-art technology.

At Westinghouse the installation of computer-integrated manufacturing equipment is preceded by a program of manufacturing process strategic planning (Sadlow, 1987). Among the key components are:

- Examining the functions of all employees throughout the business, assessing how their functions will change and communicating the necessary changes to the employees.
- Educating all employees, white collar *and* blue collar, about how the business works and how design and manufacturing processes need to run to be efficient.
- Integrating key functions—tearing down institutional walls between design and manufacturing engineering and business systems to create totally integrated product development teams that draw all their knowledge from a common data base.

Sadlow estimates that if an industry were to undertake such a process and then decide not to implement computer-integrated manufacturing, the firm would still reduce its costs by 25 percent. This is in addition to perhaps a 25 percent reduction from just combining design and manufacturing engineering to achieve the design for producibility concept described above.

4

Facing the Future

U.S. federal budget deficits have greatly distorted the structure of production and consumption in the United States and the patterns of international trade. More dependent on the United States than any other nation, Canada has been the most affected U.S. trading partner.

In the United States during the early and mid 1980s, the overvalued dollar sustained artificially high levels of income and consumption fed by imports, and it distorted the distribution of income and job opportunities. A peculiar corollary of supply-side economics emerged: "Foreigners supply the goods, and America supplies the bonds." Meanwhile, U.S. import-competing and export industries took a beating, as they were priced out of traditional markets. Adjustments accelerated and unemployment costs were exacerbated in mature industries already facing intense competition from the East Asian NICs. As Americans became more dependent on foreign consumer goods and producer durables, domestic investment and employment growth shifted even more rapidly toward the nontradeable services sector.

Customers lost between 1982 and 1985 are not easily won back. Foreign producers may be expected to fight hard to maintain newly acquired market shares, and some foreign firms have established operations in North America.

The Canadian dollar follows the broad movements of the U.S. dollar. It followed the U.S. dollar up against European currencies, while depreciating against the U.S. dollar. This further increased Canada's trade surplus with the United States and caused current account deficits with other Canadian trading partners. Canada's low dollar vis-à-vis the American dollar and growing trade surpluses attracted charges of unfair trading practices from U.S. industries, whose problems in fact could be more directly traced to the exchange rate effects of U.S. macro policies based on questionable assumptions.

The U.S. dollar has fallen substantially since 1985, returning to its 1980 level. Some progress has been achieved in reducing U.S. federal deficits; however, federal borrowing needs, external financing requirements and the effective exchange rate for the dollar have not decreased enough to bring the U.S. current account back into equilibrium. More progress in curbing federal spending and increasing revenues will be required over the next two or three years, or the growing burden of foreign debt service will start to push up U.S. external financing require-

ments and once again increase U.S. trade and current account deficits. The latter assumes that such a development is not accompanied by foreign reluctance to purchase additional dollar-denominated assets.

If the U.S. government can substantially reduce its budget deficit, the effective exchange rate for the dollar that will balance the U.S. current account is lower than a decade ago. Among the reasons are:

- U.S. productivity growth has continued to lag behind many competitors, requiring a lower dollar to maintain U.S. cost competitiveness.
- More exports will be required to pay interest on the external debt accumulated since 1982.
- In 1980 the major debtors absorbed a quarter of U.S. exports. Now many of these countries have dramatically cut their current account deficits until their financing problems are resolved, and this will have important long-term implications for U.S. exports.
- U.S. export prospects in agriculture and high technology have been curtailed by the emergence of new suppliers.
- As long as the fall of the U.S. dollar remains uneven, the sourcing of products from countries with strong currencies (e.g., Japan and Germany) can be moved to countries that have experienced only modest or no appreciation in their currencies against the U.S. dollar (e.g., Taiwan and Korea). Also, manufacturers in Germany and Japan can increase purchases of components from these sources to maintain price competitiveness in the U.S. market. Finally, export capabilities are growing in a new generation of NICs.
- The period of overvaluation was sustained and severe, causing some manufacturers to move operations or to source offshore. These decisions are now difficult to reverse.

All of these factors will require Americans to adjust to slower growing incomes and to purchase fewer imported goods. Depending on the relationship between U.S. export growth and the interest rate paid on its external debt, the United States may have to achieve significant current account surpluses to service and retire the external debt. This will require even further depreciation of the dollar and more belt tightening.

For the United States, a weaker dollar portends improved competitive opportunities for mature industries making cars, electronic products and other goods that were imported during the 1980s. Reduced competitiveness in agriculture and high technology will require mature industries to do even more. Service industries will have to pay higher wages as more remunerative opportunities become available in mature goods-producing

industries. The trend in resource movement away from goods into services will be tempered. Overall, these developments will favor the hard hit industrial centers of the Middle West.

For Canada, a weaker U.S. dollar means a weaker Canadian dollar against the yen and European currencies. In Europe and Japan, Canadian resource exports will fare better. Nevertheless, the secular trend toward less reliance on agricultural and natural resource-based products and an increased share in nonautomotive secondary manufactures in Canada's exports should continue. Other things being equal, the U.S. share of Canadian exports would be expected to decline with a weaker U.S. dollar, but the pull of free trade would ameliorate this trend.

In terms of structural issues, improving the trade performance of manufacturing, without continuous erosion in U.S. and Canadian dollar exchange rates and relative living standards, will necessitate increased innovation, faster productivity growth and continued efforts to improve quality. Achieving these will require:

- Increased investment in new plant and equipment—in the United States, to bring the pace of modernization and the introduction of new technologies closer to rates in Japan (see Table 5, p. 16, and Figure 5, p. 40); in Canada, to finance the rationalization necessary in many industries to bring productivity up to U.S. and world competitive levels.
- Increased investment in R&D to keep pace with rapidly growing efforts in Japan, Germany and several other European economies. Efforts are needed to ensure cooperation between public and private researchers and adequate commercial payoffs from publicly financed R&D. In this vein, the consequences of the large U.S. commitment to publicly financed R&D should be examined, not necessarily with the intent of curtailing this investment but rather of ensuring that commercial spinoffs are not needlessly constrained and that other, more commercial efforts are adequate.
- In the process of implementing new manufacturing processes, such as computer-assisted technologies, increased emphasis on human resource development—especially worker training and retraining and greater worker involvement in planning and implementing automation—and increased attention to effective corporate and manufacturing organization.
- Increased efforts to monitor and adopt foreign technological innovations.

In shaping public policies, it is important to recognize that the development of both the U.S. and Canadian economies has ultimately been guided by business and labor responses to market opportunities. Governments

can encourage particular activities in particular locations. At times they can tip the scales, maintaining employment in some sectors or encouraging new investment in others to achieve social or regional objectives. Ultimately, though, the ability to sustain competitiveness, free of permanent government assistance, is importantly influenced by the prices businesses must pay and the domestic and foreign availability of capital, various types of labor and other resources, as well as the domestic and foreign market opportunities for selling products.

Efforts to increase investment begin with the cost and availability of capital. U.S. savings rates seriously lag behind those in other countries, and federal deficits drain these limited resources, increasing interest rates, dependence on foreign borrowing and instability in equity markets. The misalignment of the U.S. dollar, and hence the Canadian dollar, vis-à-vis many newly industrializing countries also limits market opportunities and discourages investment in modernization and new equipment. In Canada savings performance is somewhat better, but its small domestic market, coupled with the threatened loss of access to the U.S. market, have encouraged Canadians to seek investment opportunities in the United States (Rugman, 1987). The bilateral trade agreement would provide better access to the U.S. market and make investment in Canadian manufacturing more attractive.

Beyond reducing the drain placed on domestic savings by budget deficits, the tax treatment of savings should be considered. Over the last decade, household savings have improved in Canada in contrast to the U.S. performance.

Household Savings as a Share of Disposable Income

	1968–73	1973–79	1979–85
United States	9.5%	9.6%	8.4%
Canada	7.5	12.4	14.9

Summers and Carroll (1987) found evidence that differences in the two countries' tax structures have been important—e.g., more generous tax treatment for retirement savings and investment income in Canada and the tax deductibility of consumer and mortgage interest in the United States.

Business R&D spending is ultimately an investment in intellectual capital (i.e., marketable products and patents), and increasing the availability and lowering the cost of capital are important in stimulating these efforts. However, corporate efforts to expand R&D need to be accompanied by a faster growing supply of university-trained scientists and engineers. Despite its population of less than half the size of the United States and Canada, Japan graduates about the same number of engineers as the two countries combined, lowering its R&D costs. The

amount and quality of science and mathematics training received by students prior to entering colleges and universities is critical to improving North American performance in this area.

Similarly, the advent of more sophisticated and rapidly changing manufacturing technologies makes the quality of the basic skills education received by the general workforce important for improving productivity across the board and for diffusing and assimilating new ideas and processes. In the United States, a growing body of anecdotal evidence and major studies (Committee on Science, Engineering and Public Policy, 1984; Carnegie Forum on Education and the Economy, 1986; and National Commission on Excellence in Education, 1983) have pointed to the need to improve the basic skills preparation of new labor force entrants and the qualifications and training of teachers. Improvements in science and mathematic literacy, numerical reasoning, problem solving skills, reading, and written communications appear critical. Special emphasis is required at the primary and secondary levels on increasing the amount of science and mathematics taught and the pool of qualified teachers; at the university level on expanding the proportion of science and engineering students and foreign language training.

Domestic policies to improve North American competitiveness should be complemented by initiatives to improve the functioning of the international financial system and market access abroad. With respect to exchange rates, efforts to achieve more stability should bring major exporting NICs into the process of exchange rate adjustment and policy coordination. With respect to trade negotiations, efforts should be made to improve market access for North American services and high technology products, the protection of intellectual property rights and reform of agricultural support programs.

There are no easy answers. Action is required on many fronts by both the private sector and public policymakers. We must strengthen our R&D infrastructure, dissemination of technology to mature industries, educational institutions, and savings and investment performance generally. If we fail, North American productivity growth will lag behind Europe and Japan, our currencies and relative living standards will decline, and we will lose the mantle of global industrial leadership.

APPENDIX TABLE 1

SUMMARY OF CHANGES IN COMPARATIVE COMPETITIVENESS AND INDUSTRY STRUCTURE

		U.S.	Canada	Japan	France	Germany	U.K.
A. Changes in International Competitiveness, Export-Import Ratios							
Technology-Intensive	1969	1.78	0.78	3.41	1.13	3.04	3.16
	1973	1.48	0.74	4.58	1.18	3.02	1.41
	1979	1.52	0.77	5.67	1.38	2.40	1.39
	1981	1.56	0.82	7.38	1.24	2.42	1.43
	1983	0.90	0.79	5.77	1.11	2.08	0.92
	1985	0.75	0.81	6.67	1.22	2.19	1.04
Capital-Intensive, Standardized	1969	0.53	1.29	1.50	0.83	0.71	0.60
	1973	0.41	1.29	1.22	0.97	0.82	0.67
	1979	0.39	1.38	1.09	1.03	0.84	0.76
	1981	0.49	1.42	1.24	1.13	0.90	0.72
	1983	0.43	1.50	1.08	0.99	0.85	0.69
	1985	0.31	1.41	1.04	1.02	0.89	0.66
Labor-Intensive	1969	0.33	0.22	14.92	1.31	0.73	1.22
	1973	0.33	0.24	1.60	1.40	0.70	0.89
	1979	0.38	0.20	1.04	0.86	0.59	0.72
	1981	0.36	0.24	1.70	0.83	0.61	0.61
	1983	0.20	0.19	1.83	0.78	0.64	0.54
	1985	0.13	0.20	1.32	0.79	0.69	0.55
B. Changes in Industry Structure, Shares of Manufacturing Value Added (Percent)							
Technology-Intensive	1969	0.44	0.30	0.40	0.34	0.41	0.39
	1973	0.45	0.31	0.42	0.36	0.43	0.40
	1979	0.47	0.32	0.49	0.40	0.44	0.41
	1981	0.47	0.32	0.54	0.41	0.46	0.43
	1983	0.45	0.31	0.56	0.41	0.47	0.43
	1985	0.47	0.32	0.60	0.42	0.49	0.44
Capital-Intensive, Standardized	1969	0.38	0.52	0.45	0.54	0.45	0.41
	1973	0.38	0.51	0.42	0.51	0.45	0.41
	1979	0.37	0.50	0.42	0.48	0.44	0.40
	1981	0.36	0.51	0.38	0.46	0.43	0.41
	1983	0.35	0.52	0.37	0.45	0.41	0.41
	1985	0.34	0.50	0.34	0.43	0.41	0.39
Labor-Intensive	1969	0.08	0.08	0.11	0.11	0.10	0.09
	1973	0.08	0.08	0.09	0.09	0.08	0.09
	1979	0.07	0.08	0.08	0.07	0.07	0.08
	1981	0.06	0.08	0.07	0.07	0.06	0.08
	1983	0.06	0.08	0.07	0.07	0.06	0.08
	1985	0.06	0.07	0.06	0.07	0.05	0.08

Sources: OECD, Foreign Trade by Commodities (Series C), and United Nations, *Yearbook of Industrial Statistics*, Volume I, various years.

APPENDIX TABLE 2

INDUSTRY GROUPINGS

Technology-intensive industries undertaking relatively large amounts of R&D and using relatively more skilled labor:

transportation equipment (384)*
electrical machinery (393)
professional goods (385)
machinery, not elsewhere classified (382)
industrial chemicals (352)
other chemicals (352)

Capital-intensive standardized goods industries producing products with large amounts of capital—generally undertaking less R&D and more capital than the first group:

rubber products (355)
plastic products (356)
petroleum refining and coal products (353-354)
nonferrous metals (372)
metal products (381)
pottery, glass and other nonmetallic products (361-369)
iron and steel (371)
food and beverages (311-313)
paper products (341)

Labor-intensive industries using larger amounts of less skilled labor—generally undertaking less R&D and using fewer skilled workers and less capital than the other two groups:

textiles (321)
apparel (322)
leather products (323)
footwear (324)

*Three digit numbers are International Standard Industrial Classification Codes—industries not included are tobacco products, furniture and fixtures, printing and publishing, and other miscellaneous products.

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